299-W18-165 (A7647)
Log Data Report

Borehole Information:

Borehole:	299-W18-165 (A7647)		Site:	216-Z-1A Crib	
Coordinates (WA St Plane)		GWL[1] (ft):	None	GWL Date:	07/25/06
North (m)	East (m)	Drill Date	TOC Elevation	Total Depth (ft)	Type
135402.403	566532.425	03/77	675.75 ft	135	Cable tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded Steel	2.2	8 5/8	8	5/16	2.2	115
Welded Steel	2.0	6 5/8	6	5/16	2.0	135

Borehole Notes:

The logging engineer measured the steel casing diameter and stickup using a steel tape.

The "Well Construction and Completion Summary" indicates grout outside the 8-in. casing to 20 ft and between the 6- and 8-in. casings to 115 ft. The casing was perforated from 118.9 to 123.9 ft and jet shot perforated from 97 to 127 ft. The bottom of the borehole was plugged to an undocumented depth. The geologist's notes indicate radiological contamination from 57 to 60 ft and from 91 to 100 ft. A carbon tetrachloride odor was noted at 52 and 60 ft.

Log data acquisition is referenced to the top of casing.

Logging Equipment Information:

Logging System:	Gamma 1E		Type:	HPGe (70%) SN: 34-TP40587A
Effective Calibration Date:	05/02/06	Calibration Reference:	DOE-EM-GJ1200-2006	
		Logging Procedure:	GJO-HGLP 1.6.5, Rev. 1	

Logging System:	Gamma 4 H		Type:	PNLS SN: U1754
Effective Calibration Date:	03/06/06	Calibration Reference:	DOE-EM-GJ1154-2006	
		Logging Procedure:	GJO-HGLP 1.6.5, Rev. 1	

Logging System:	Gamma 4 I		Type:	NMLS SN: H310700352
Effective Calibration Date:	N/A	Calibration Reference:	Not required	
		Logging Procedure:	GJO-HGLP 1.6.5, Rev. 1	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	5
Date	07/26/06	07/26/06	07/27/06	07/31/06	08/01/06
Logging Engineer	McClellan	McClellan	McClellan	McClellan	McClellan
Start Depth (ft)	2.0	45.0	54.0	77.0	96.0

Log Run	1	2	3	4	5
Finish Depth (ft)	45.0	55.0	78.0	97.0	125.0
Count Time (sec)	200	400	400	400	400
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
ft/min	NA	NA	NA	NA	NA
Pre-Verification	AE181CAB	AE181CAB	AE182CAB	AE183CAB	AE184CAB
Start File	AE181000	AE181044	AE182000	AE183000	AE184000
Finish File	AE181043	AE181054	AE182024	AE183020	AE184029
Post-Verification	AE181CAA	AE181CAA	AE182CAA	AE183CAA	AE184CAA
Depth Return Error (in.)	N/A	+ 1.25	- 1	0	+ 0.25
Comments	No fine gain adjustment	No fine gain adjustment	No fine gain adjustment	No fine gain adjustment	No fine gain adjustment

Log Run	6 Repeat				
Date	08/02/06				
Logging Engineer	McClellan				
Start Depth (ft)	65.0				
Finish Depth (ft)	50.0				
Count Time (sec)	400				
Live/Real	R				
Shield (Y/N)	N				
MSA Interval (ft)	1.0				
ft/min	NA				
Pre-Verification	AE185CAB				
Start File	AE185000				
Finish File	AE185015				
Post-Verification	AE185CAA				
Depth Return Error (in.)	+ 0.5				
Comments	No fine gain adjustment				

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	7	8 Repeat			
Date	08/02/06	08/02/06			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	100.0	110.0			
Finish Depth (ft)	125.0	120.0			
Count Time (sec)	15	15			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	0.25	0.25			
ft/min	NA	NA			
Pre-Verification	DH212CAB	DH212CAB			
Start File	DH212000	DH212101			
Finish File	DH212100	DH212141			
Post-Verification	DH212CAA	DH212CAA			
Depth Return Error (in.)	N/A	- 1			
Comments	None	None			

Passive Neutron Logging System (PNLS) Log Run Information:

Log Run	9	10 Repeat			
Date	08/03/06	08/03/06			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	2.0	90.0			
Finish Depth (ft)	125.0	105.0			
Count Time (sec)	60	60			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	1.0			
ft/min	NA	NA			
Pre-Verification	DI462CAB	DI462CAB			
Start File	DI462000	DI462124			
Finish File	DI462123	DI462139			
Post-Verification	DI462CAA	DI462CAA			
Depth Return Error (in.)	N/A	- 1			
Comments	None	None			

Logging Operation Notes:

Logging was conducted with a centralizer on each sonde and measurements are referenced to top of casing. Moisture data were acquired from 100 ft to the bottom of the borehole (125 ft). The moisture measurement is influenced by the grout and double casing to 115 ft and is reported in count rate rather than volumetric moisture. The counting time used to acquire SGLS data was 200 seconds from the ground surface to 45 ft. The remainder of the borehole data were acquired at 400 seconds to improve counting statistics and to lower the MDL for the low specific activity transuranic radionuclides such as Pu-239.

Analysis Notes:

Analyst:	P.D. Henwood	Date:	05/30/07	Reference:	GJO-HGLP 1.6.3, Rev. 0

Pre-run and post-run verifications for the logging systems were performed before and after the day's data acquisition. The acceptance criteria were met.

A combined casing correction for a 0.625 in. thick casing (0.3125 + 0.3125 for the 8- and 6-in. casings) was applied to the SGLS data from the ground surface to 115 ft. Below 115 ft, a correction for 0.3125-in. thick casing was applied for the 6-in. casing.

SGLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with an EXCEL worksheet template identified as G1EMay06.xls using an efficiency function and corrections for casing, dead time, and water as determined from annual calibrations. The NMLS data were not converted to volumetric moisture and are reported in counts per second. The NMLS calibration is not valid for double cased and grouted boreholes. The passive neutron data are used for qualitative purposes and do not require a calibration. Data are reported in count rate.

Results and Interpretations:

Am-241is detected from 93 to 96 ft. The maximum concentration is measured at approximately 225,000 pCi/g at 95 ft. Gamma rays at approximately 662 and 722 keV were detected that represent Am-241. Cs-137 emits a 661.66 gamma ray that cannot be distinguished from the 662.40 gamma ray emitted from Am-241. A corroborating energy peak at 722.01 keV is used to establish the presence of Am-241 rather than Cs-137. In this borehole the 622.40 keV energy peak is used to determine the Am-241 concentration. There appeared to be no residual counts in the 662 keV peak that could be attributed to Cs-137.

Pu-239, often detected with Am-241, is not detected in this borehole above an MDL of approximately 15,000 pCi/g.

Np-237 is detected with the SGLS by measuring a daughter product (protactinium-233 that emits a prominent gamma ray at an energy of 312.17 keV. Pa-233 was detected from 53 to 55 ft and from 93 to 97 ft. The maximum concentration is approximately 12 pCi/g at a 54 ft depth.

Passive neutron logging was performed in the borehole. This logging method has been shown to be effective in qualitatively detecting zones of alpha-emitting contaminants from secondary neutron flux generated by the (α,n) reaction and may indicate the presence of α-emitting nuclides, including transuranic radionuclides, even where no gamma emissions are available for detection above the MDL. The passive neutron signal depends on the concentration of α sources, and also the concentrations of lighter elements such as N, O, F, Mg, Al, and Si, which emit neutrons after alpha capture. The passive neutron log indicated a maximum count rate of 5 counts per second (cps) at 94 ft.

Moisture data indicate some variability although grout is reported to be in the annular space between the 6- and 8-in. casings from 100 to 115 ft. Between 115 and 125 ft, an increase in relative moisture content is observed.

The SGLS, NMLS, and PNLS repeat logs all show good repeatability.

Total gamma log data were acquired in this borehole in 1986 by Pacific Northwest Laboratory. Elevated count rates were observed at approximately 56 and 92 ft and are consistent with the profile of the SGLS total gamma data when depth for the casing stickup is adjusted.

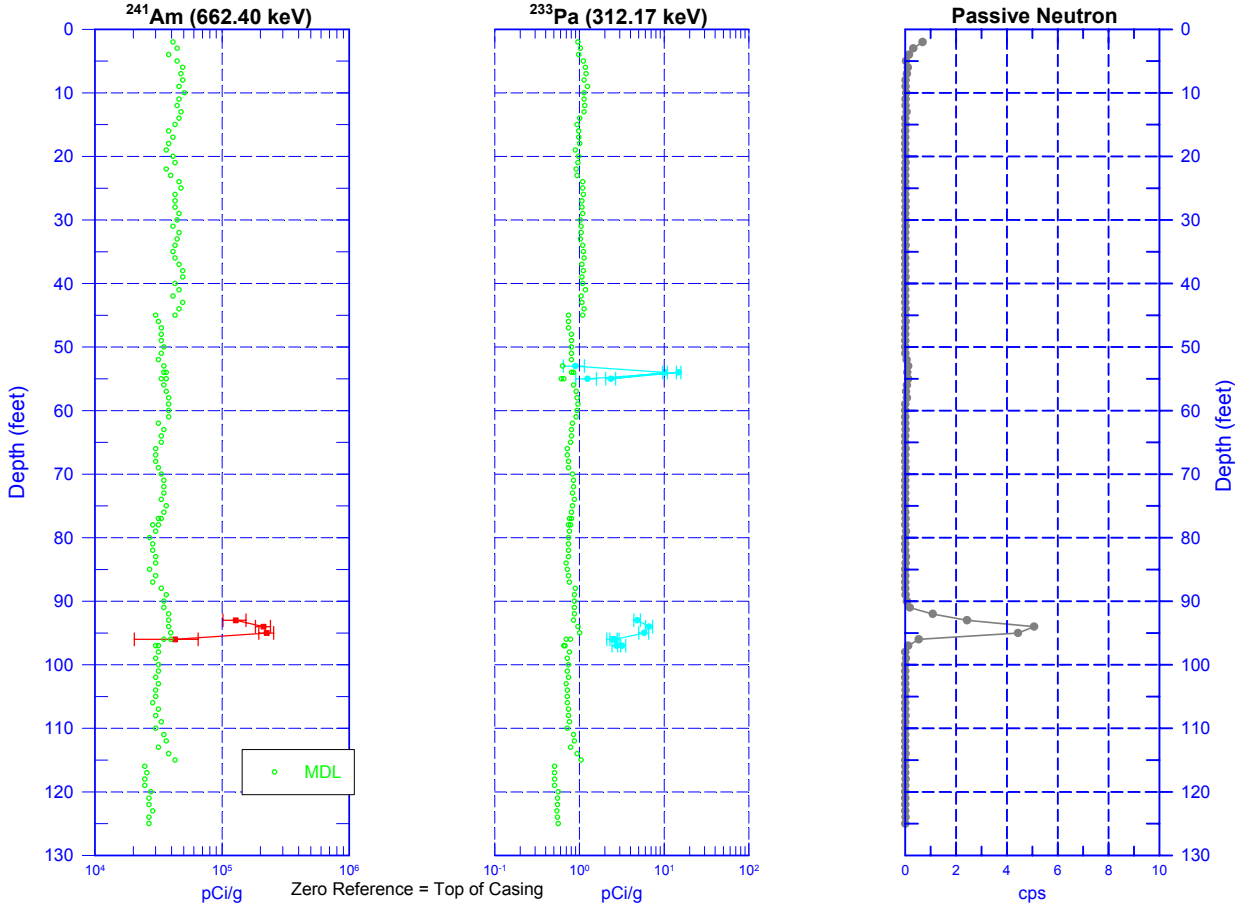
List of Log Plots:

Depth Reference is top of casing
Depth Scale - 20 ft/inch except for repeat logs

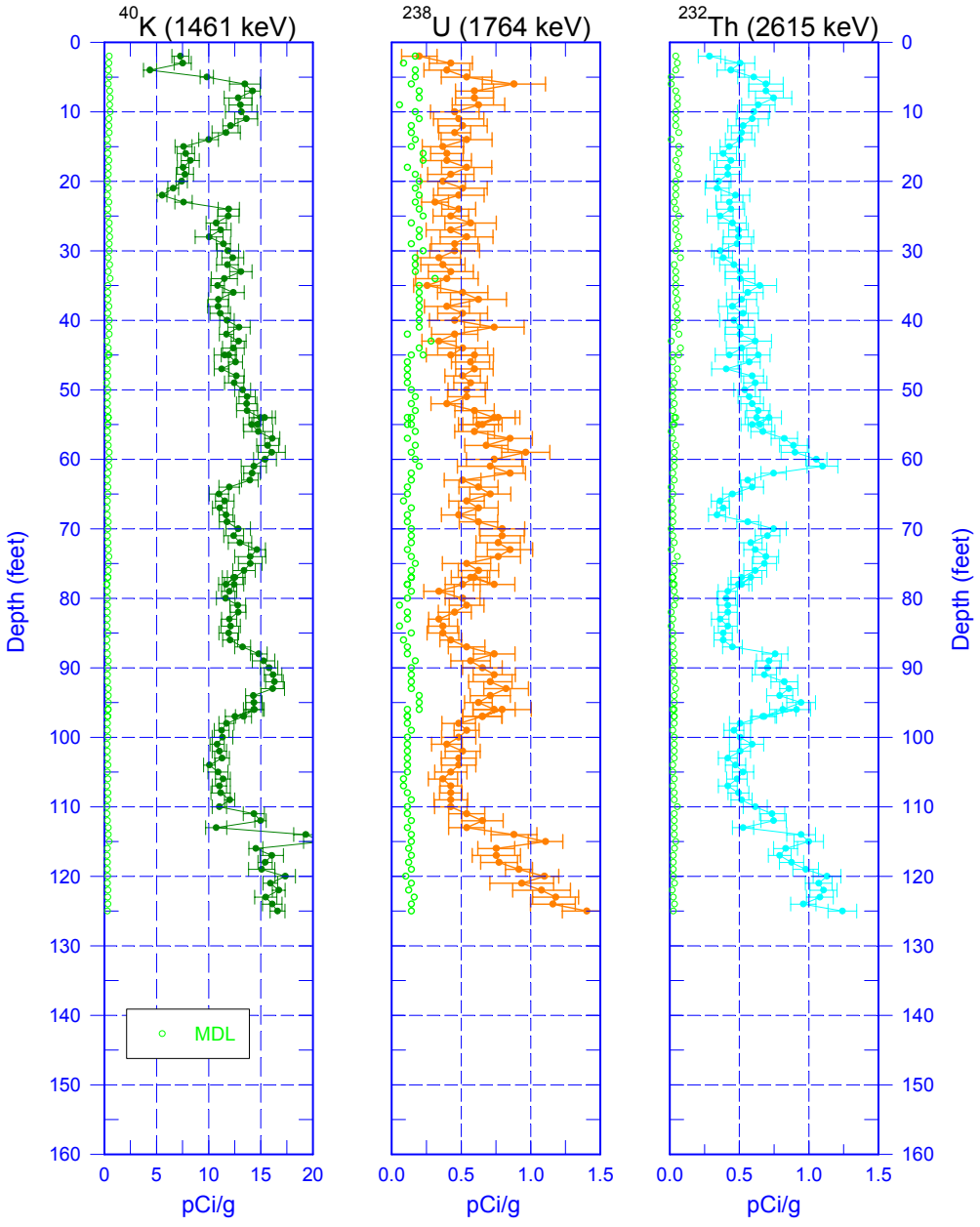
Manmade Radionuclide Plot
Natural Gamma Logs
Combination Plot
Total Gamma, Moisture, & Passive Neutron
Total Gamma & Dead Time
Manmade Repeat Section
Repeat Section of Natural Gamma Logs
Total Gamma & Moisture Repeat Section

[1] GWL – groundwater level

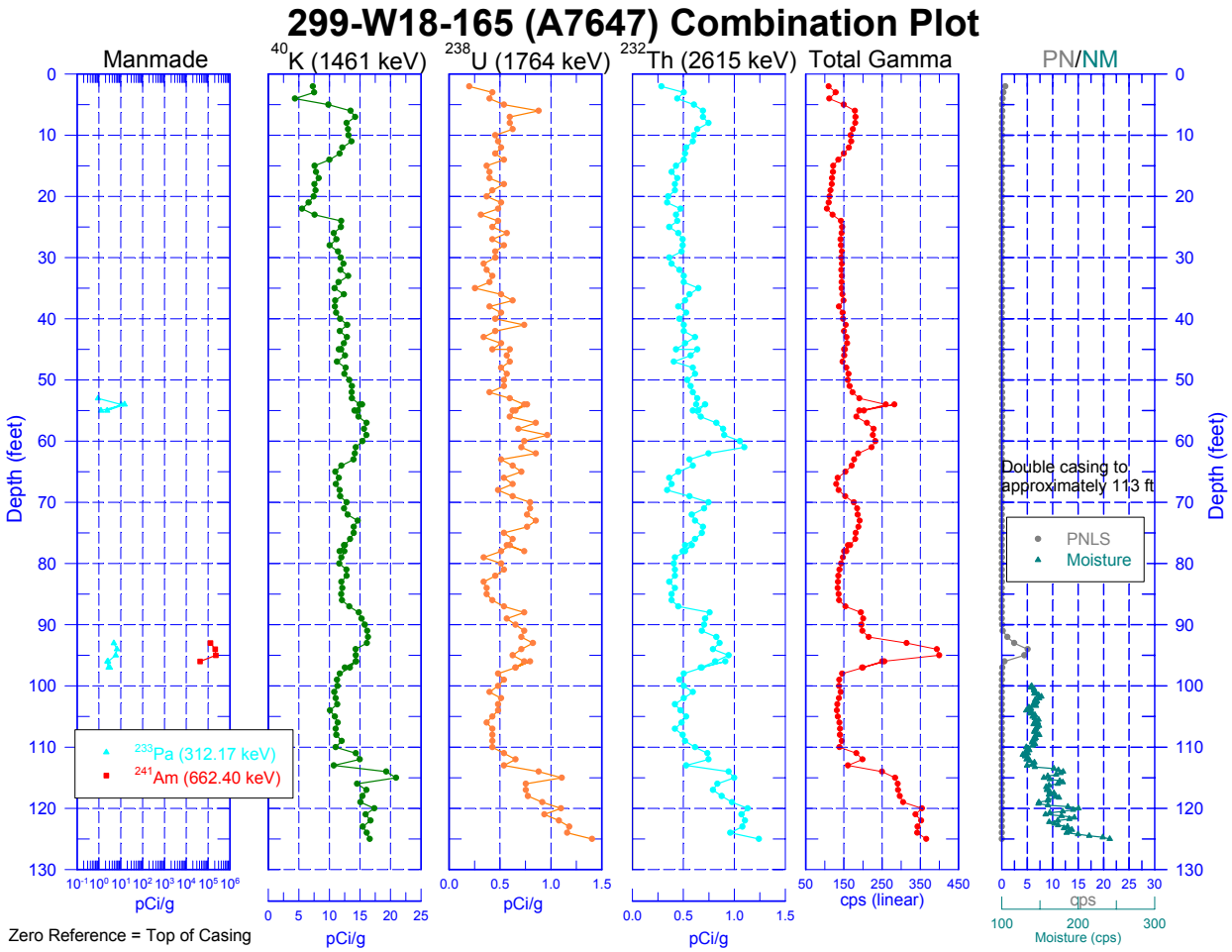
299-W18-165 (A7647) Man-made Radionuclide Plot



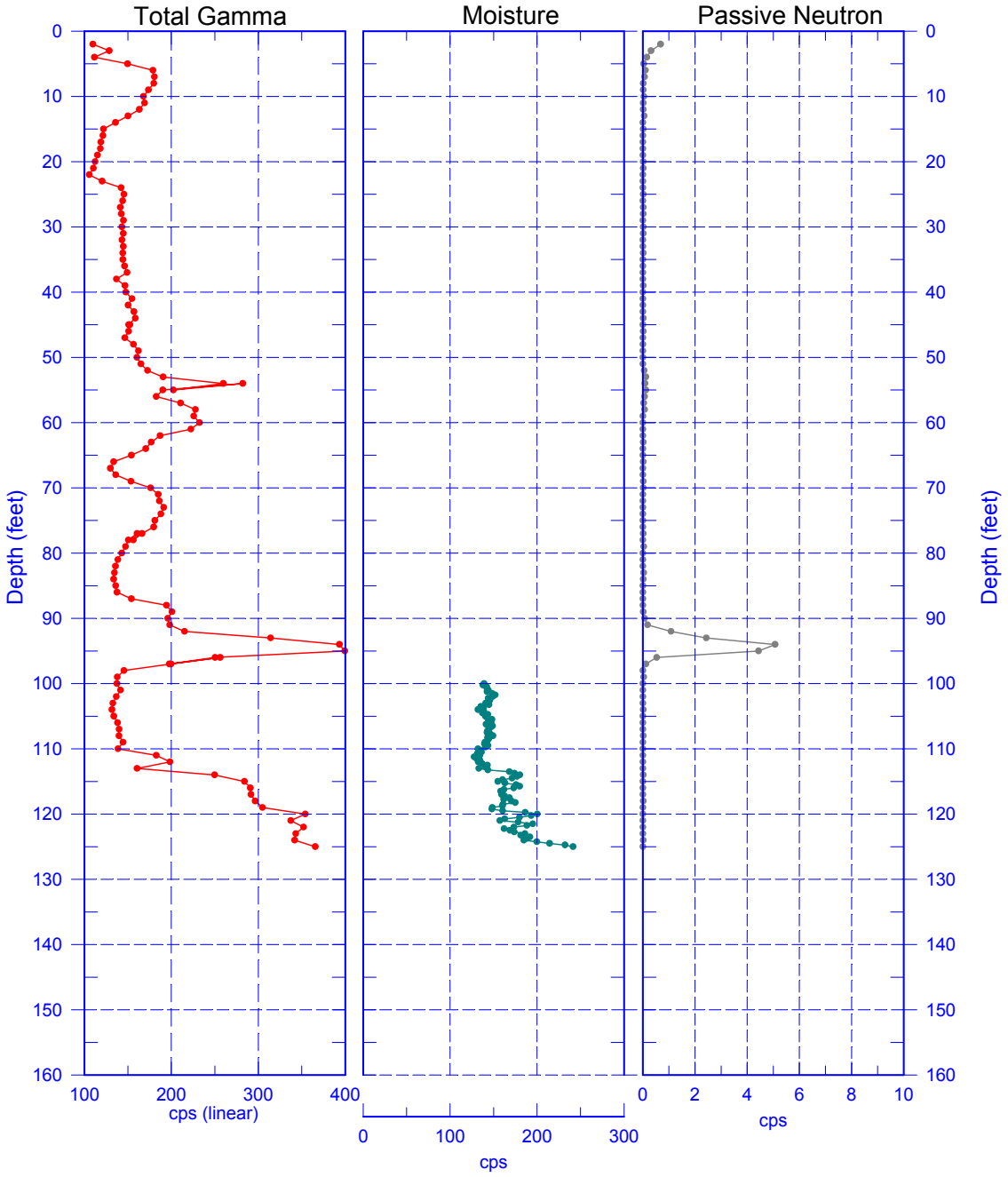
299-W18-165 (A7647)
Natural Gamma Logs



Zero Reference = Top of Casing

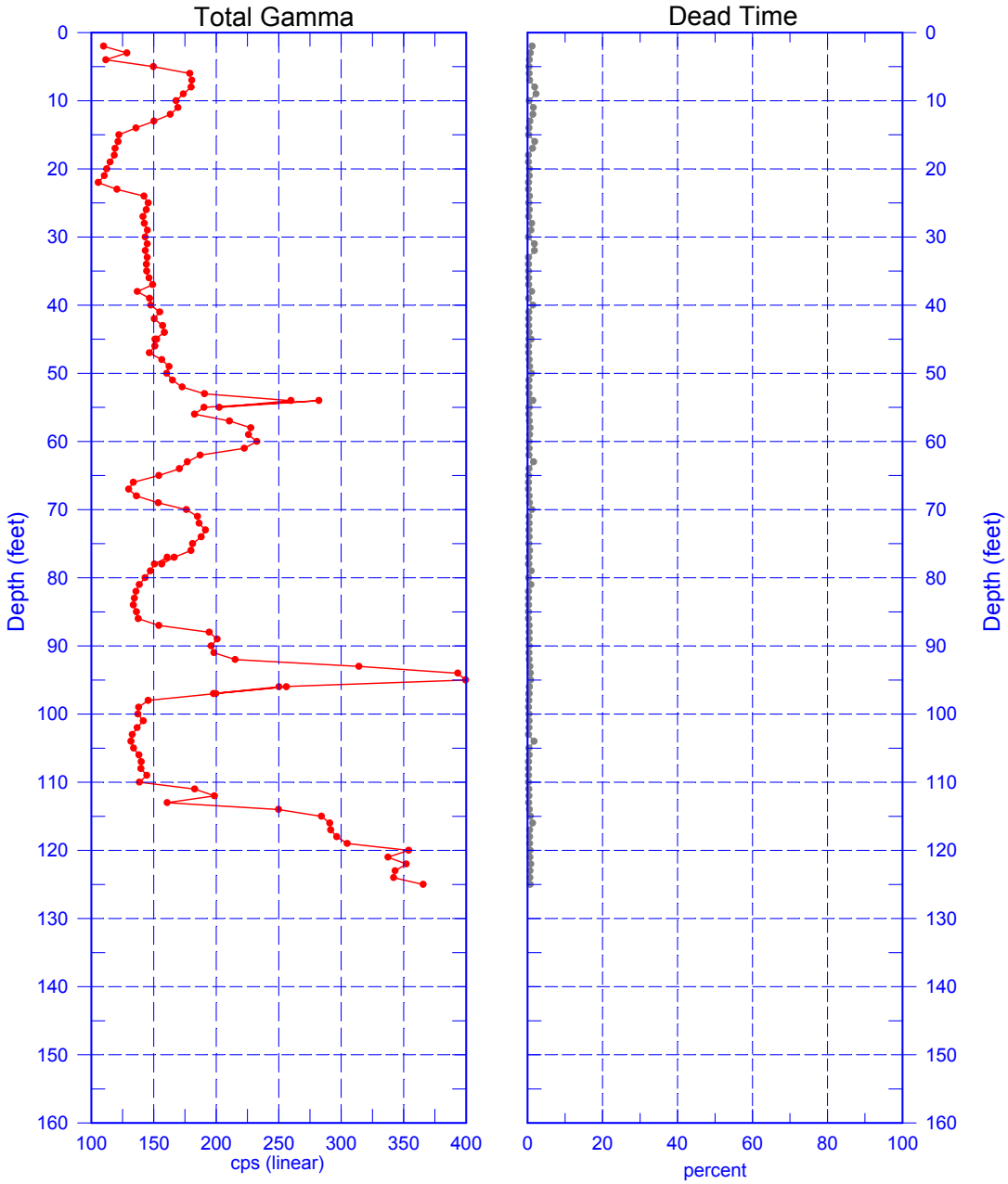

299-W18-165 (A7647) Combination Plot
Manmade
40K (1461 keV)
238U (1764 keV)
232Th (2615 keV)
Total Gamma
PN/NM
Depth (feet)
233Pa (312.17 keV)
241Am (662.40 keV)
pCi/g
Zero Reference = Top of Casing
cps (linear)
Double casing to approximately 113 ft
PNLS
Moisture
cps
Moisture (cps)

299-W18-165 (A7647)
Total Gamma, Moisture, & Passive Neutron



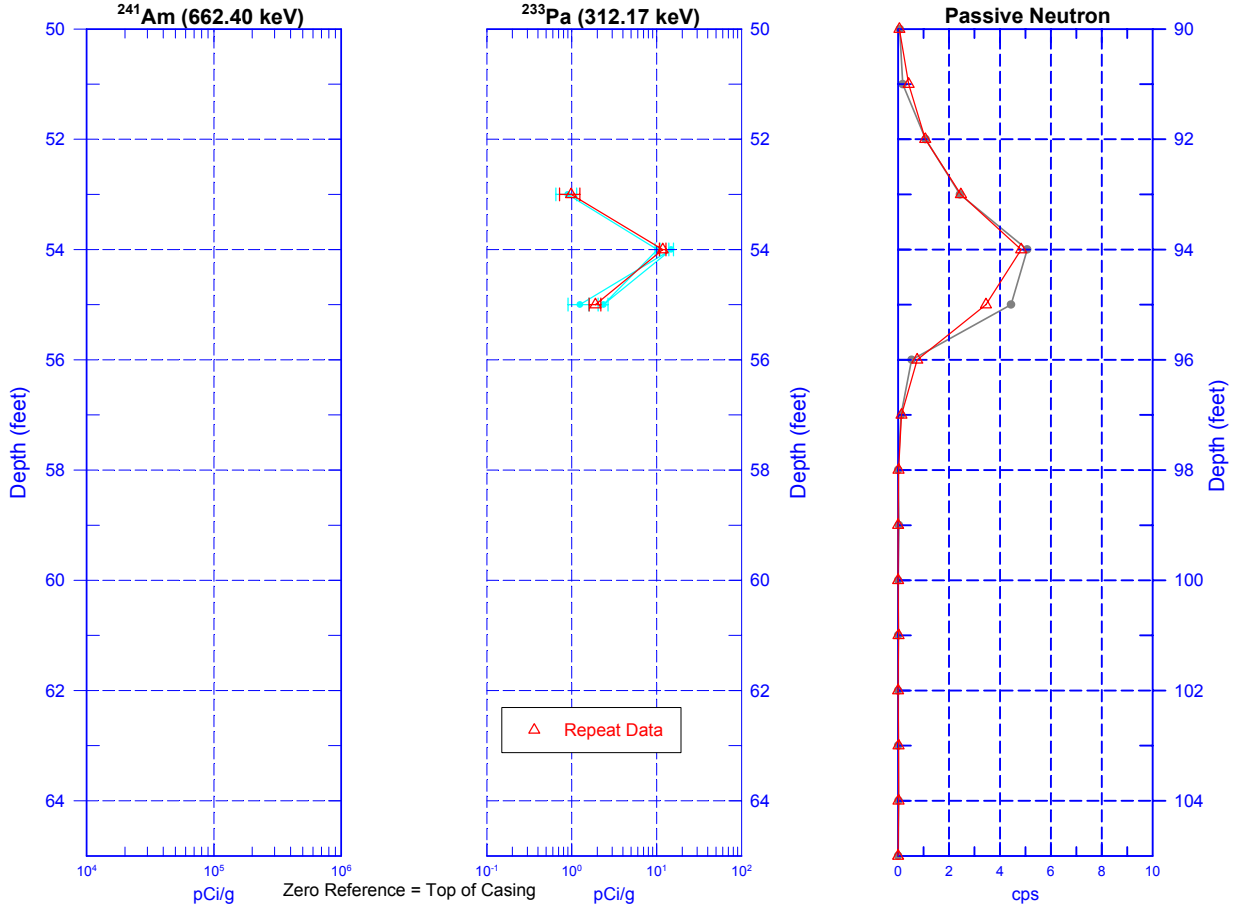
Reference - Top of Casing

299-W18-165 (A7647)
Total Gamma & Dead Time



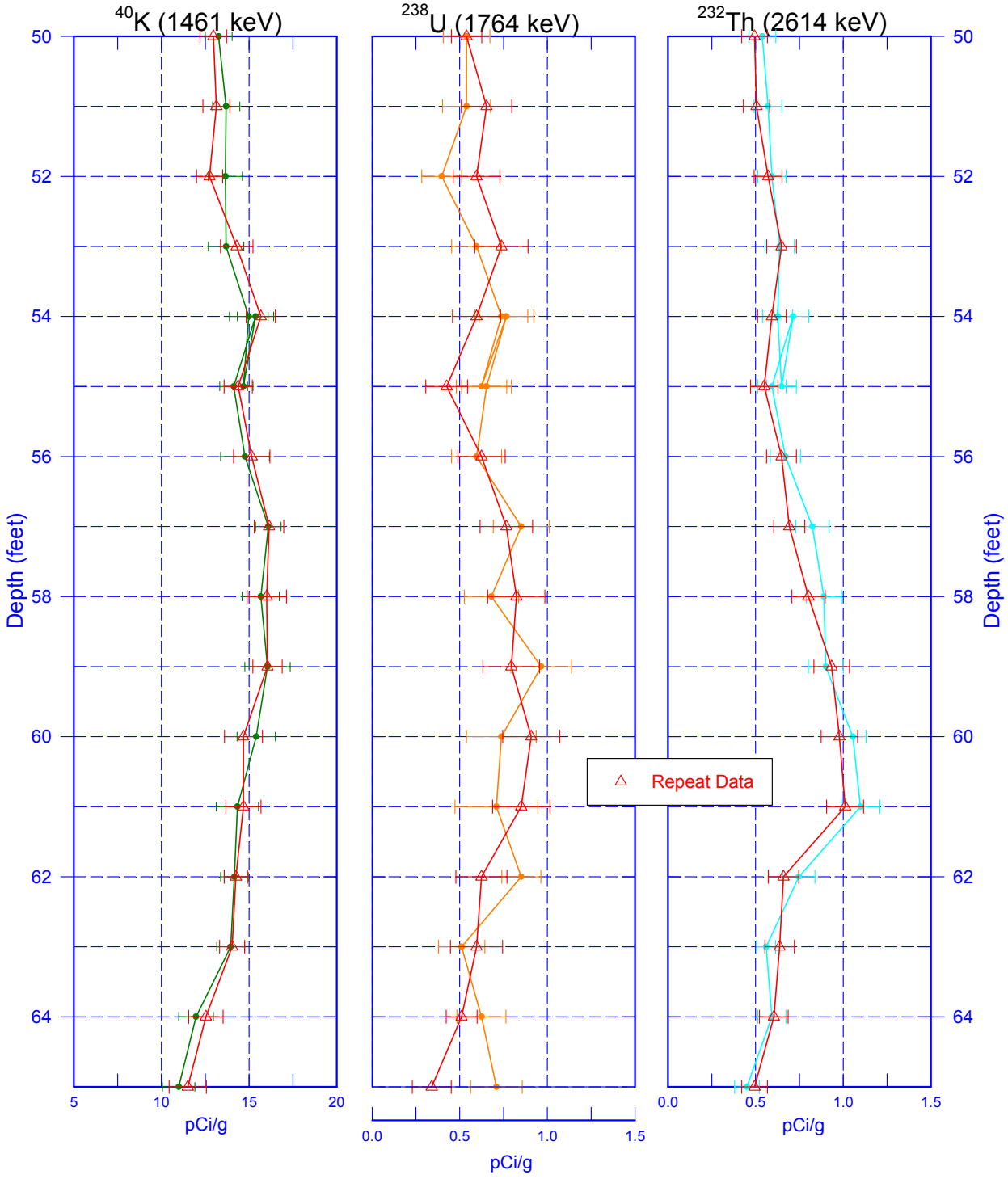
Reference - Top of Casing

299-W18-165 (A7647) Manmade Repeat Section

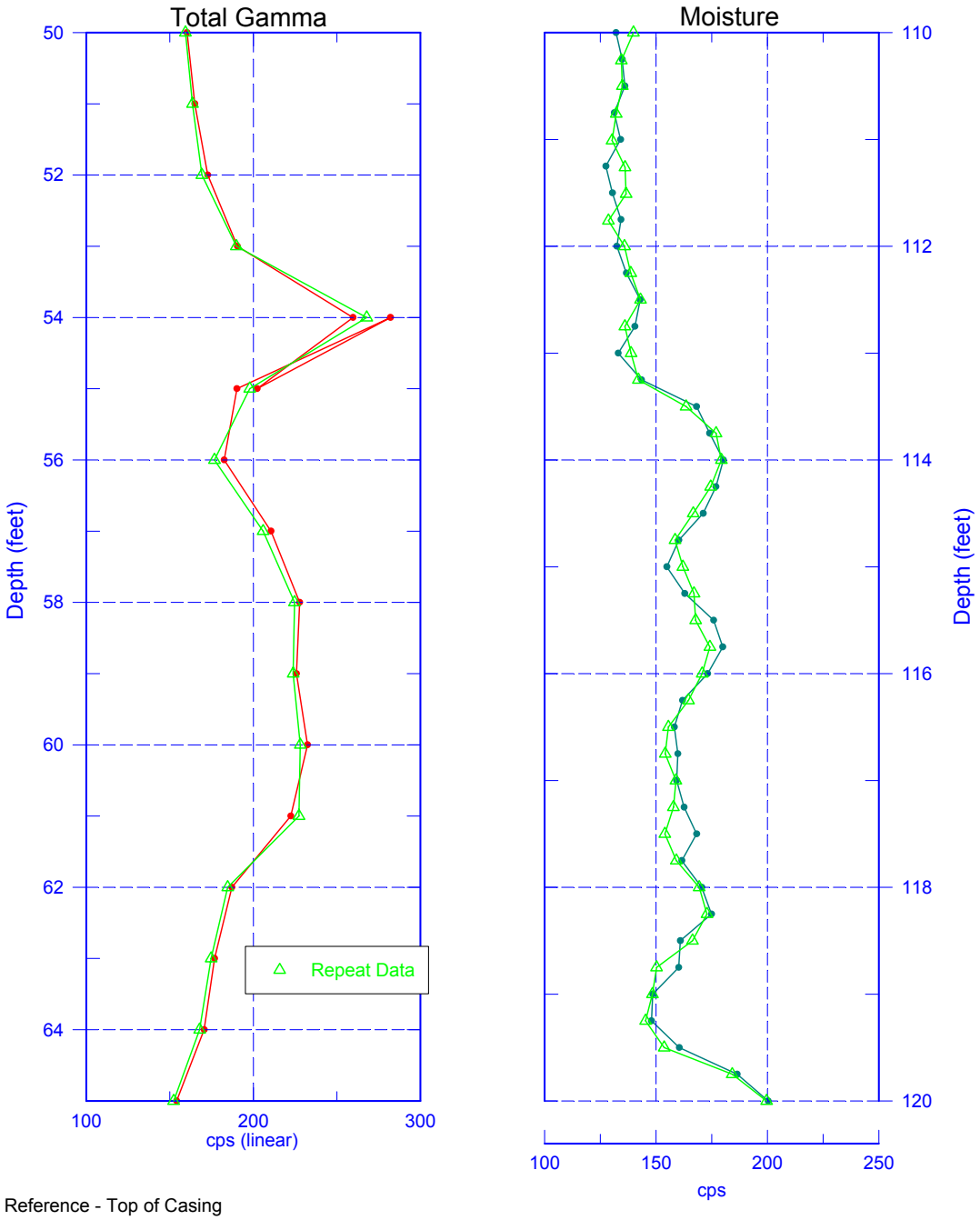


299-W18-165 (A7647)

Repeat Section of Natural Gamma Logs



299-W18-165 (A7647)
Total Gamma & Moisture Repeat Section



Reference - Top of Casing